might be reallocated to meet these needs. (Although television broadcast operations employ much aural service equipment, such as remote pickup transmitters for program, coordination, and remote control, cuing devices, and wireless microphones, spectrum needs for these applications are not nearly as critical as the needs for additional video transmission spectrum.)

1. Background

In the three prior Interim Reports of SG-3, the use of broadcast-support facilities used in television operations has been described, possible long-term solutions to fulfill additional requirements have been suggested, and a survey taken by NAB of current broadcast microwave usage in the top markets has been described. Spectrum requirements have been considered for compatible, augmentation, and simulcast systems. The current thrust is on simulcast systems, which will have the greatest impact on the need for additional support spectrum. Analog, or hybrid analog-digital systems have been considered, while, at the present time, some changes to additional digital proposals are being discussed. This development could also affect the requirements for support spectrum. Also, although it is not clear at this time, it appears that there will be at least some degree of duplicate NTSC and ATV transmissions over support facilities.

Based on the NAB survey of the top markets, in many instances currently allocated microwave channels are used to the fullest extent with the likelihood of additional capacity

within the current structure being almost nil. Los Angeles is a good example. There are 15 TV transmitters atop Mt. Wilson, each with at least two microwave circuits between the studio and this site, one STL and one TSL. Most of the stations are heavily involved in ENG operations, involving the use of one or more microwave channels on the ENG vehicle and typically several microwave channels from repeater points to Mt. Wilson. (Because of the mountainous terrain and the wide area served by the Los Angeles stations, several repeater sites are required.) There is also extensive use of Cable Television Relay Service (CARS) stations in the Los Angeles area that share the same frequencies used by the broadcasters.

The use of the existing frequencies by all the parties involved is made possible only by the close coordination process employed by the local frequency coordinating committee. The possibility of accommodating additional channels is virtually nonexistent.

2. Possible Solutions for Lessening Spectrum Needs

It must be recognized that the installed base of existing equipment and the economics of acquiring or leasing new facilities will be a factor with respect to the timetable for full implementation of ATV. However, SG-3 has identified the following possible items for easing spectrum requirements:

- fiber optics to replace or augment fixed microwave circuits (See Appendix C for a discussion on the potential of fiber optics);
- video compression techniques to reduce per TV signal bandwidth;

— improvements in equipment and operating techniques, including FM deviation optimization, larger and shrouded antennas, and lower noise figures for pre-amps and receivers;

— better utilization of the currently allocated but lightly used 18, 23, 30 and 40 GHz bands;

— possibility of using a single STL carrying ATV which could be "ownconverted[2]" to NTSC at the dual-transmitter site.

- for satellite service, the possible eventual use of the 20/30 GHz bands.

3. Additional Spectrum

a. Relevance of the Work of SG-4

Specialist Group 4 was charged with examining the spectrum above 1 GHz to identify blocks of spectrum that might possibly be used to establish an ATV service, in the event that an ATV service could not be accommodated in the VHF/UHF television bands. Fortunately, it appears now that ATV can be so accommodated. If not needed for the broadcast service, the frequencies identified between 1 - 13 GHz might be considered for support facilities. (The results of the ATV propagation and channel characteristics tests are not needed for the application suggested herein, since this band is known to be eminently suited for point-to-point microwave links.)

The FCC, in its original NOI, requested information on the 2.5 - 2.69 GHz and 12.2 - 12.7 GHz bands, which roughly

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[2]With respect to conversion, it has also been suggested that, if continuous service on the ATV transmitter becomes a requirement, it may be possible to "up-convert" NTSC programming to pseudo-ATV, roughly analogous to the use of synthesized stereo audio for TV.

bracket the major band of interest, 1 - 13 GHz. The results of the work of SG-4 have been described in its Interim Reports, but are briefly summarized herein as possible candidates for additional broadcast-support spectrum.

b. 2.5 - 2.69 GHz Band

This band is allocated to the ITFS/OFS/MDS/MMDS services and is used extensively, primarily in the major markets. Recent FCC actions, designed to foster MMDS development, made it even more dubious that this band could provide any help.

c. 4.4 - 4.99 GHz Band

This band is allocated domestically to the government Fixed and Mobile Services, but is currently set aside for high-powered military tropo-scatter systems. It is our understanding that these systems are mainly in warehouses awaiting deployment as needed. The principal use in the U.S. during peacetime is presumably for training exercises in limited geographic areas remote from urban centers. This band would appear worthy of consideration for new broadcast-support spectrum.

d. 7.5 - 7.9 GHz Band

This band is allocated domestically to the government Fixed Service only. It is used by two or possibly three agencies for non-military microwave relay systems of intermediate length. The intensity of use is not known. If government use is not heavy, it may be feasible to devise a plan

whereby the band could be shared with the Auxiliary Broadcast Service.

e. 12.2 - 12.7 GHz Band

This is the Broadcast Satellite Service (BSS) downlink band. Although the service was authorized over eight years ago, there are currently no operating systems. However, there are many authorizations extant with more about to be made.

One of the major broadcast-support uses is for satellite distribution and contribution circuits in the Fixed Satellite Service (FSS) band. In addition to the heavy use by broadcasters, there are over 200 other video services distributed by satellite. There is some indication that video compression techniques will first be employed in the FSS, which might lead to the accommodation of all satellite requirements, even in the short-term.

In its Second Interim Report SG-3 states: "Should the DBS band with its 9 degree orbital spacing continue to be under-utilized in the future, conceivably some of this spectrum might be considered for additional FSS channels."

f. Other Spectrum Possibilities

It is noted that the FCC has suggested several frequencies for possible use for a Digital Audio Broadcast (DAB) service, including 1493 - 1525 MHz and 2390 - 2450 MHz. If for one reason or another these bands are not selected for DAB, consideration should be given to providing additional broadcast-support channels in some parts of this spectrum.

It is also noted that the NAB has instituted a study of possible spectrum for DAB. Here again, any bands identified for possible use, and not selected for DAB, might be considered for broadcast-support channels.

F. Conclusions

There are two critical issues which will have a major impact on the broadcast auxiliary spectrum requirements for advanced television. The interpretation of simulcast, if defined to permit some operation independent from the NTSC channel will require more auxiliary circuits. The choice of a particular ATV system could also have a substantial effect on broadcast auxiliary spectrum requirements.

Future work of Specialist Group 3 will focus on the results of the questionnaire recently sent to proponents seeking information that will give the system specific non-broadcast spectrum requirements. The non-top-30 market auxiliary STL spectrum study (North Carolina) that was conducted during this reporting period demonstrated that even in a medium density population area, additional STL and other auxiliary spectrum will be needed. The amount of additional spectrum required will be related to the degree of efficient use of existing spectrum and potential utilization of alternative technologies.

Based on current information, the bands 4.40 - 4.99 GHz and 7.75 - 7.90 GHz represent the best possibilities for providing additional channels, at least for the short term for ATV broadcast-support spectrum. It is recommended that the

FCC institute a dialogue with the NTIA to consider these proposals. (The SG is aware of the pending legislation that would transfer 200 MHz of government spectrum to the private sector. Hopefully the needs of the new ATV service would be considered in any such re-allocation.)

SG-3 will also follow the developments in the search for DAB spectrum for other possibilities for added spectrum for new ATV support facilities.

IV. ACCOMMODATING ATV IN THE SPECTRUM ABOVE 1 GHZ (SPECIALIST GROUP 4)

In the Third Interim Report, Specialist Group 4 (PS/SG-4) reviewed its charge, described the work done to date at that time, and indicated that PS/SG-4 would defer any further activities pending a review of the propagation test results from the Advanced Television Test Center (ATTC). In view of the preliminary but promising results with respect to the possibility of accommodating ATV within the existing VHF/UHF television broadcast bands, and the higher priority ATTC tasks of planning for the system laboratory tests, the preparation of the raw propagation test results into a format suitable for analysis remains to be done. Since the question of terrestrial broadcasting in the spectrum above 1 GHz might still have some relevance, any further action by PS/SG-4 will continue to await the availability of the propagation data for analysis. Specialist Group 4 also took note of the fact that tests have been conducted on terrestrial broadcasting in the 12 GHz band in Mexico City. Since the test results may be of

interest, they will be submitted to Specialist Group 4 for review and discussion.

V. SPECTRUM ANALYSIS AND TABOOS (SPECIALIST GROUPS 6, 7 AND 9)

The work of Specialist Groups 6/7 (SG-6/7) of PS/WP-3 has not required the convening of meetings during the period covered by this Fourth Interim Report. However, progress has been made toward the ultimate objectives assigned to SG-6/7 dealing with spectrum availability for ATV systems, including the impact of "taboos" if applicable to ATV. That progress is reported in the balance of this section.

PS/WP-3 and, more specifically, SG-6 will be required to provide the accommodation statistics and allotment tables for each ATV system when data are available from both objective and subjective laboratory tests. (Assignment tables will be required also, but decisions relative to assignment principles are not within the scope of PS/WP-3.) Most importantly, the laboratories will have to supply data concerning desired and undesired power combinations for interference from ATV to NTSC, NTSC to ATV, and ATV to ATV. (With suitable definitions of ATV and NTSC power, these combinations can be expressed as ratios.)

The first of the three interference ratios specified (ATV to NTSC) will permit a determination of ATV power/height levels and separations necessary to avoid unacceptable interference to NTSC stations. Starting at separations which studies show to be necessary for full accommodation of

existing television licensees, and employing the ATV power/ height level determined to be the maximum permissible to avoid unacceptable interference to NTSC, the latter two interference ratios will be used to predict the extent of the ATV service area. Although in some directions the limit of the ATV service area may be determined by the signal-to-noise ratio, interference is expected to be the primary determinant of the extent of service. If calculations demonstrate that ATV stations spaced to permit full, or nearly full, accommodation have an unacceptably small service area, the relationship between ATV service area and accommodation will be determined.

Accomplishment of the foregoing objectives requires a computer program permitting consideration of the entire United States database of authorized stations and a sufficient part of the Canadian and Mexican television allotments to permit the development of a table for ATV simulcast allotments. That program should have the capability of applying different allotment algorithms and taking into account any taboos that need to be retained for the ATV service. Additionally, a computer program permitting the rapid preparation of graphical representations of service areas as affected by interference for a variety of spacing and power/height combinations is desirable, although manual determinations of service areas are feasible. The Zenith Corporation has developed a computer program running on a personal computer (PC) for the plotting of the interference-free service areas needed. However, additional work on that program is needed to make it maximally

useful for the task at hand. Arrangements have not yet been completed to expand the program as necessary.

Fortunately, the Broadcasters' Caucus of the Advanced Television Systems Committee has taken on the task of programming and running a computer to solve the allotment problem. A program has been written, and preliminary data are becoming available. Emphasis must be given to the fact that allotment tables for the proposed ATV simulcast stations cannot be produced until the laboratory data referred to above are available. However, as a first task, studies have been undertaken to determine the impact of taboos on total accommodation statistics. The results of those studies are reported below.

The studies examined the impact of keeping and/or relaxing some or all of the existing NTSC taboos on the availability of ATV spectrum. Specifically, they examined the impact of protecting a single NTSC taboo, such as the first, second, third, fourth, seventh, eighth, fourteenth or fifteenth channel removed from the assigned NTSC channel (i.e., above and below the assigned channel), or multiple taboos (intermodulation, cross modulation, IF, 1/2 IF Beat, etc.) on the overall availability of ATV spectrum. Also included in the analysis is the effect of reducing taboo mileage separations as well as allowing collocation, or near collocation of the taboo channel.

Three different scenarios were used to assess the availability of spectrum for ATV. The first scenario applied

the taboo restrictions to all ATV and NTSC assignments. The second scenario applied the taboo restrictions only to existing NTSC assignments. The third scenario also applied the taboo restrictions to existing NTSC assignments; however, it allowed collocation or near collocation of the taboo channel.

Document PS/WP-3-165 contains detailed findings and observations of these studies. (A revised version of this document is attached as Appendix F.) However, they can be consolidated into four preliminary findings:

1) Regardless of which scenario was examined, the adjacent channel taboo was determined to achieve the worst accommodation statistics for ATV, while the IM-related taboos exhibited the best statistics.

2) The NTSC/Collocated Scenario was determined to achieve the best accommodation statistics.

3) Except for the picture image taboo, the effect of increasing or reducing taboo separation distance has little or no impact on the ATV accommodation statistics.

4) Allowing exact collocation of the taboo channel slightly/moderately improves the accommodation statistics of ATV. Near collocation of the taboo channel adds little, if any, improvements to the accommodation statistics.

With regard to the work of Specialist Group 9 dealing with cross-border issues, no further meetings have been held during the reporting period with Canada relative to allotments for an Advanced Television System. Reorganization of the

Canadian group has not yet been completed so they have not been in a position to continue the joint work previously begun.

VI. PLANNING FACTORS DEVELOPMENT (SPECIALIST GROUP 10)

A. Introduction

Planning factors will form the structure for determining the basic service area(s) for the new ATV service. This section sets forth the work of PS/WP-3 on a) Planning Factors Development, b) Definition of Spectrum Criteria, and c) Criteria Evaluation.

B. Factors Development

The factors described below determine the noise-limited service area in the absence of interference from other stations. This will be based on ERP, antenna height, and typical receiving systems for specified availability statistics. The existing rules for NTSC define two grades of service, Grade A, defined by an inner contour, and Grade B, defined by an outer contour. It has been suggested that if two contours are necessary for the ATV service, these should be ATV Service Contour I (inner), and ATV Service Contour II (Outer). However, as the chosen ATV system will more likely than not be digital, it has been suggested that, since for such systems the signal drop-off will be rapid at a certain single distance, only one service area should be defined. In this is case, it would be an interference limited service area that would approximate that of the Grade B NTSC service area.

Table VI-1

Advanced Television Service Grade II				Channels 2-6		Channels 7-13		Channels 14-69	
Planning Factors			Units	Zone-I	-II, III	-I	-I & III	-I	II & III
1.	Maximum Height Above Average Terrain (HAAT)		feet	1000	2000	1000	2000	2000	2000
2.	Geometric Mean Frequency		MHz	69	69	194	194	615	615
3.	ATV Effective Radiated Power (ERP)		dBK						
4.	Thermal Noise	(N_t)	dB/μV	2.6	2.6	2.6	2.6	2.6	2.6
5.	Receiver Noise Figure	(N_r)	dB	5	5	5	5	10	10
6.	S/N Ratio (Reference to Carrier)		dB						
7.	Line Loss	(L)	dB	2	2	3	3	5	5
8.	Receiver Antenna Gain	(G)	dB						
9.	Dipole Factor	(K_d)	dB	-3	-3	-12	-12	-22	-22
10.	F(L,T) Field		dBμV/m						
11.	F(50,50) Field		dBμV/m						
12.	To Overcome Urban Noise	(N_u)	dB	0	0	0	0	0	0
13.	To Overcome Rural Noise	(N_r)	dB	0	0	0	0	0	0
14.	Required Median Field		dBμV/m						
15.	Receiver Antenna Discrimination		dB						
16.	Cross-Polarization Factor		dB						
17.	Co-channel D/U no offset	a. ATV-NTSC	dB						
		b. NTSC-ATV	dB						
		c. ATV-ATV	dB						
18.	Co-channel D/U Nominal offset	a. ATV-NTSC	dB						
		b. NTSC-ATV	dB						
		c. ATV-ATV	dB						
19.	Co-channel D/U Precise offset	a. ATV-NTSC	dB						
		b. ATV-ATV	dB						
		c. ATV-ATV	dB						
20.	Adjacent Channel D/U (Lower)	a. ATV-NTSC	dB						
		b. NTSC-ATV	dB						
		c. ATV-ATV	dB						
21.	Adjacent Channel D/U (Upper)	a. ATV-NTSC	dB						
		b. NTSC-ATV	dB						
		c. ATV-ATV	dB						
22.	Taboos - See separate list								

Items 17-22 in Table VI-1 will be used to determine the extent of interference from other stations permitted within the ATV service area resulting from the maximum mileage separation for cochannel, and adjacent channel, and taboo-related stations.

These contours indicate the approximate extent of coverage over average terrain in the absence of interference from other television stations. Under actual conditions, the true coverage may vary greatly from these estimates where the terrain differs from the average terrain on which the field strength propagation curves are based.

To develop planning factors for an Advanced Television Allotment Plan, PS/WP-3 established Specialist Group 10. This specialist group used as its point of departure the factors used in the development of the NTSC channel Allotment Plan. It modified these factors to take account of the new information which would have to be added for ATV channels. Table VI-1 represents the status of development of the parameters. In general, the factors fall into three categories: a) those which can be identified now; b) those which can be determined in the near future; c) those which cannot be determined until after tests of proponent systems have been carried out.

The status of development of these factors is as follows:

(1) Maximum Height Above Average Terrain (HAAT). The antenna heights indicated are the existing maximum values. These values were used since such antennas do exist and could

possibly serve as the supporting structure for the ATV antennas. Stations exceeding these heights would be subject to an appropriate reduction in allowable effective radiated power.

(2) Geometric Mean Frequency. This factor is used to determine the effective length of the receiving antenna, or the dipole factor (item 9). The value for any specific channel might differ from these geometric mean values, but for this generalized approach these values are appropriate. (The maximum difference of the value is 2 dB for channels 2-6; but only 1 dB for 7-13 and UHF).

(3) ATV Effective Radiated Power (ERP). This very important parameter is still under development and has been the subject of cqnsiderable discussion (see below).

(4) Thermal Noise. The indicated value is the inherent noise within 6 MHz across 75 ohms.

(5) Receiver Noise Figure. The values indicated are typical values that may be expected for new ATV receivers.

(6) Carrier-to-Interference Ratio. This parameter cannot be determined until ATTC/CRC tests are performed.

(7) Line Loss. The indicated figures are based on 35 feet of RG-59-U.

(8) Receiving Antenna Characteristics. Information has been requested from manufacturers of receiving antennas.

(9) Dipole Factor. The indicated values are based on a 75 ohm impedance and the geometric mean frequency for the band, i.e. Dipole Factor = 20 log 48.341/F (with F in MHz).

(10) F (L,T) Field. Values for L and T will be added based on appropriate location and time probability functions after the service statistics are determined.

(11) F (50,50) Field. With the FCC's F (50,50) propagation curves, the transmitting antenna height (1), and ERP (3), this value will determine the service contour.

(12) Urban Noise. For ATV Service Grade II, no allowance is indicated to overcome urban noise. However, for Service Grade I, if necessary, urban noise factors of 14 dB for channels 2-6, 7 dB for channels 7-13, and 0 dB for UHF should be used.

(13) Rural Noise. For ATV Service no allowance is indicated to overcome urban noise.

(14) Required Median Field. This is the required median field associated with ATV Service Grade II (the noise limited contour which may be different for different ATV systems).

(15) Receiver Antenna Discrimination. It has not been determined if this factor is necessary.

(16) Cross-Polarization Factor. It has not been determined if this factor is necessary.

C. Spectrum Criteria for a New Terrestrial ATV Simulcast System

During this period, SS/WP-4, which is charged with recommending an ATV standard, requested a statement from PS/WP-3 on how to judge the spectrum related aspects of a particular system. A response was formulated and agreed to on 11 September 1990 and then forwarded to SS/WP-4. This statement made the following points:

(1) The ATV System must afford the opportunity for substantially all existing television stations to have an ATV service area comparable to the NTSC Grade B service area.

(2) This requirement must be achieved with ATV-to-NTSC and ATV-to-ATV minimum cochannel spacing in the order of 160 km (100 miles).

(3) The criteria that the systems must meet are --

(a) minimize interference to existing NTSC stations;

(b) insensitivity to interference from NTSC or other ATV stations, and

(c) provision of satisfactory ATV service at a carrier-to-noise ratio lower than that applicable to the NTSC service.

Any new ATV system must satisfy these criteria. The PS/WP-3 statement went on to indicate the procedure for determining the satisfaction of these criteria through the ATTC laboratory tests:

> Although both the VHF and UHF television bands are expected to be utilized in any simulcast ATV system adopted, studies show that most of the accommodation must come from the UHF band. Characteristics of NTSC receivers have required that restrictions be placed on the use of as many as sixteen channels other than the same or first adjacent channels. Those channels so restricted are referred to as "taboo" channels. Utilization of those taboo channels is essential to provide the spectrum needed for terrestrial simulcast broadcasting of ATV. Laboratory tests will demonstrate if that threshold is satisfied by any ATV system, or the extent that some taboo restrictions must be retained for the protection of NTSC or ATV reception.
>
> The laboratory will provide data also on the noise-limited service afforded by each proposed ATV system, interference to and from NTSC and ATV-to-ATV interference. For the

cochannel case, interference to NTSC will be made at two NTSC receiver input levels corresponding, approximately, to receiver inputs at the Grade B and Grade A signal contours. ATV power levels will be referenced to a common base. Unlike NTSC, where the peak of sync provides a constant reference for power determination, ATV systems are not expected to include comparable capability. Consequently, the selection of a reference for the ATV systems will require a degree of subjectivity. However, the power reference so determined is expected to provide a common base permitting systems to be compared.

Service predictions for each ATV system studied will start with the undesired ATV signal level, above or below the reference power at the receiver input, causing objectionable cochannel interference to NTSC reception. Then, using propagation data appropriate to the television band, and assuming 160-kilometer cochannel spacing and height above terrain similar to that used for NTSC, the permissible transmitted level of power above the reference will be determined. The degree of interference to NTSC permitted will be comparable to that caused by NTSC-to-NTSC at typical cochannel spacing.

Having determined the permissible ATV transmitted effective radiated power, test data on service limitations imposed by noise, and interference from NTSC-to-ATV, will be applied to predict the extent of the ATV service. Available propagation data pertinent to the television band will be used again, in conjunction with the permissible power level determined as described in the previous paragraph. The calculations will provide a determination of the extent that ATV service will be interference-limited or noise-limited.

In the event that the foregoing does not yield an ATV service area at 160-kilometer spacing comparable to the service area provided by NTSC, cochannel spacing will be increased until that objective is achieved. An analysis will then be made of the accommodation statistics applicable to the increased cochannel spacing.

> In the event that laboratory testing demonstrates the need to retain taboo restrictions for particular ATV systems, spectrum analyses will be made to evaluate the impact of those restrictions on accommodation.

It is anticipated that SS/WP-4 will provide data of the nature described above to PS/WP-3. Subsequently, PS/WP-3 will "provide an analysis of the extent that proponents have satisfied the criteria set forth above. Success or failure will be measured by the size of the ATV service provided simultaneously with maximum accommodation of either increasing cochannel spacing to improve service area size, or limiting channel usage because of taboo restrictions."

D. Evaluation of ATTC Information

In anticipation of the above, PS/WP-3 has also initiated steps to evaluate the measurement information which will be provided for purposes of providing service area evaluation of the proponent systems. This effort was undertaken as a consequence of the initiative by Zenith to develop computer software of its own as described in Section V. It is offering to make it available to PS/WP-3. Its stated purpose is to provide a methodology for "objectively differentiating the proponent systems from the viewpoint of service area and interference impact from both on and from existing NTSC service."

It is intended that the characteristics of this program provide outputs of:

- NTSC Grade B contour
- Noise limited ATV service contour

- Equivalent signal power at ATV receiver input in dBm versus distance from ATV transmitter
- Time variability conversion versus distance from 50% to 90%.

The inputs to the program are:

Band	LV, HV, U
Desired ERP	dBK
Undesired ERP	dBK
Desired HAAT	feet
Undesired HAAT	feet
Transmitter Spacing	miles
NTSC and ATV Ant F/B	dB
Ant. Gain	dB
Line Loss	dB
Receiver NF	dB
ATV C/N	dB
ATV D/U	dB

The Working Party agreed to pursue development of this capability. In addition, coordination has been established with the ATTC to provide data in the proper format.

In summary, WP-3 has made substantial progress in establishing Planning Factors which can be used to provide a basis for coverage area evaluation for proponent systems.

E. Discussion on the Definition of Power Levels

The Working Party spent considerable time in discussing the definition and proper measurement of ATV Effective Radiated Power listed in Subsection A, above. Zenith present-

ed a paper which indicated, after extensive analyses, that to avoid measurements leading to wrong conclusions (in the measurement of ATV proponent power), Levels 2 and 3 in the test procedure developed by SS/WP-2 should be at 15 dB and 30 dB above a reference level, respectively. It was Zenith's view that obtaining measured information at these levels would provide a better indication of a system's interference immunity.

As a consequence of these discussions, and similar discussions in other related committees, it is understood that the ATTC test plan was modified to accommodate this problem. In connection with this issue, PS/WP-3 also communicated to SS/WP-1 to indicate that the "dynamic range of the test receivers should become part of the certification process".

VII. FUTURE WORK

During the next reporting period, Specialist Group 3, the specialist group assigned responsibility for analyzing the impact of ATV on broadcast support services and non-broadcast spectrum uses, will (a) analyze the responses received from the proponents regarding carriage of their particular ATV signals on microwave and other types of contribution and distribution circuits, (b) survey existing manufacturers of contribution and distribution equipment regarding issues associated with the transmission of ATV signals on their systems, and (c) continue to further narrow the set of recommendations in the area for which it is responsible.

During the next reporting period, Specialist Groups 6 and 7 will continue their work dealing with broadcast spectrum availability for ATV systems. In particular, they will complete their currently on-going studies regarding the impact of "taboos" that are potentially applicable to ATV systems. In addition, these specialist groups will continue their efforts regarding the possible development of the computerized service area and interference model for evaluating and comparing ATV transmissions systems. Following the work just described, further efforts by these two specialist groups will, by and large, have to wait on the results of the tests of the proponent ATV systems by the ATTC.

Specialist Group 9, which has been working on cross border issues involving Canada and Mexico, will reinforce its efforts to re-establish contacts and a constructive working relationship with appropriate Canadian representatives, and to establish initial contacts with appropriate Mexican officials.

Finally, Specialist Group 10, will continue its work in establishing the recommended planning factors that will form the technical structure for determining the basic service areas for the new ATV service. In particular, the specialist group anticipates acquiring information from the manufacturers of television receiving antennas regarding the technical characteristics of their products. This specialist group will also continue to consider the proper definition of coverage areas for ATV systems while paying particular attention to the special characteristics of digital transmissions systems.

Appendix A

Microwave Technical Specifications

Conventional microwave communications of video/audio signals for terrestrial transmission utilize a number of bands. Following are the principle bands and bandwidth:

Band (in GHz)	BW (in MHz)
2	17
7	25
13	25
18	20, 40, or 80

Appendix B

Electrical Performance of NTSC Microwave Links

The electrical performance of NTSC microwave links is established by national standard, ANSI/EIA/TIA-250-C-1989. Many of the specifications are couched in terms of NTSC parameters. Furthermore, different performance requirements are made depending on the number of links (or hops) and the total distance traveled. A few of the most stringent requirements ("Short Haul" classification) that might be applicable to ATV channels are:

Amplitude Frequency Response

0.1 dB	(.01-0.5 MHz)
0.1 rising to 0.18 dB	(0.5-3.0 MHz)
0.18 falling to 9.1 dB	(3.0-3.25 MHz)
0.1 dB	(3.3-3.9 MHz)
0.1 rising to 0.18 dB	(3.9-4.2 MHz)

Envelope Delay Response

50 ns	(0.2-3.6 MHz)

Signal-to-Noise Ratio
67 dB

Signal-to-Low-Frequency-Noise Ratio
53 dB

Signal-to-Periodic-Noise Ratio
67 dB

In addition to these requirements, there are a number of distortions that are measured strictly in terms of NTSC performance. They include:

Chrominance to Luminance Gain and Delay Inequalities
Field, Line and Short-Time Distortions
Insertion Gain and Variation
Luminance Nonlinearity
Differential Gain and Phase
Chrominance-to-Luminance Intermodulation
Chrominance Nonlinearity Gain and Phase

Appendix C

Fiber Optics

Use of optical fiber transmission as a substitute for radio frequency transmission in broadcast auxiliary operations may provide additional contribution and distribution channels where these facilities are available, where they are economic, and where mobility is not required. Broadcast auxiliary operations embrace studio-to-transmitter links (STLs), remote program pickups, studio-to-studio transmission feeds, and electronic news gathering (ENG). These operations are currently supported by point-to-point microwave radio (fixed, temporary-fixed and mobile), satellite transmission, coaxial circuits, and, to some extent, fiber optic media. In many circumstances, availability and economics interact to favor the use of radio-based technologies over fiber optic or other land line transmission means.

While intercity and local fiber optic installations by telecommunications companies are continuing at a good pace, fiber is not omnipresent. In addition, within any given geographic area, fiber is not available at or near every location where there could potentially be a television broadcast. In many instances, it might not be feasible to extend fiber to a particular site for a single or occasional television broadcast.

For example, if the available time to prepare for the broadcast of a remote event is not in the order of a week, or so, it may not be possible to arrange for the provision of